



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,068	01/22/2004	Xiaogang Peng	40715-296579	3712
23370	7590	12/19/2008		
JOHN S. PRATT, ESQ KILPATRICK STOCKTON, LLP 1100 PEACHTREE STREET ATLANTA, GA 30309			EXAMINER LIGHTFOOT, ELENA TSOY	
			ART UNIT 1792	PAPER NUMBER
			MAIL DATE 12/19/2008	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/763,068

**Applicant(s)**

PENG ET AL.

**Examiner**

Elena Tsoy Lightfoot

**Art Unit**

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 October 2008.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-98 and 100-108 is/are pending in the application.  
4a) Of the above claim(s) 1-57, 69-98 and 100-108 is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 58-68 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 22 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

***Request for Reconsideration***

The Request for Reconsideration filed on October 21, 2008 has been entered. Claims 1-98, and 100-108 are pending in the application. Claims 1-57, 69-98, and 100-108 are withdrawn from consideration as directed to a non-elected invention.

***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 58-68 stand rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. Claims 58 and 59 recite “*resulting in a mixture comprising the solution of core nanocrystals, the cation precursor solution and the anion precursor solution*”, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicants argue that numerous sections of the specification, including page 5, lines 26-29 and page 64, lines 24-31, and the originally filed claims, including claims 58-68, describe adding, in an alternating manner, cation and anion precursor solutions to a solution of core nanocrystals. Adding cation and anion precursor solutions to a solution of core nanocrystals results in the formation of a mixture comprising the solution of core nanocrystals, cation precursor solution and anion precursor solution. This mixture is formed whether or not the core nanocrystals are coated.

The Examiner respectfully disagrees with this argument. First of all, the Examiner would like to clarify that core nanocrystals coated with a monolayer of  $M^2X^2$  are no longer exist as a *mixture* comprising the solution of core nanocrystals, cation precursor solution and anion precursor solution because cation in the monolayer  $M^1X^1$  does not exist separately from anion but reacts with anion forming  $M^2X^2$  on the surface of the core nanocrystals  $M^1X^1$ .

Second, in contrast to Applicants statement, the Applicants' specification describes *nowhere* (including page 5, lines 26-29 and page 64, lines 24-31, and the originally filed claims, including claims 58-68) that adding cation and anion precursor solutions in an alternating manner to a solution of core nanocrystals *results in the formation of a mixture comprising the solution of core nanocrystals, cation precursor solution and anion precursor solution*. Claim 58 recites forming a **first monolayer**. The Applicants specification describes in P161 that when *monolayer accuracy* was desired, the core nanocrystal is contacted *alternately* with a cation precursor solution and an anion precursor solution, in which both cation and anion precursor solution were employed in an amount *sufficient* to form one monolayer of the shell material. Thus, after forming monolayer no uncoated core particles would be left in the reaction mixture since both cation and anion precursors were added in an amount **sufficient** to form the monolayer.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 58-68 stand rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Language of claims 58 and 59 stays confusing because it is not clear how after covering the core nanocrystals with a monolayer of cation, the core nanocrystals are still present by the time of adding anion precursor.

Applicants argue that definiteness of claim language must be analyzed, not in a vacuum, but in light of several factors including the claim interpretation that would be given by one possessing the ordinary level of skill in the art and the content of the particular application disclosure. As understood by one of skill in the art and as set forth in the present specification, in order to form a shell on a core nanocrystal, cationic species and anionic species are required. Cationic species are clearly set forth in the specification and pending claims as M while anionic species are clearly set forth as X. Deposition of a monolayer of cation on a core nanocrystal does not destroy the core nanocrystal or render it unavailable to receive the anionic species for reaction with the cationic species to form a shell. Depositing a monolayer of cation on a core nanocrystal alone does not form a shell as contemplated by the present claims.

The Examiner respectfully disagrees with this argument for the reasons discussed above.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 58-68 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reiss et al (*Nano Letters*, 2 (7), 781 -784, 2002) in view of Nicolau (US 4675207) for the reasons of record set forth in paragraph 6 of the Office Action mailed on 4/22/2008.
7. Claims 58-68 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reiss et al in view of Nicolau, further in view of state of art admitted by Li et al (JACS, 9/23/2003) for the reasons of record set forth in paragraph 7 of the Office Action mailed on 4/22/2008.
8. Claims 58-68 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reiss et al (*Nano Letters*, 2 (7), 781 -784, 2002) in view of Kondow et al (US 5300793) and Nicolau (US 4675207) for the reasons of record set forth in paragraph 3 of the Office Action mailed on 4/2/2007 for the reasons of record set forth in paragraph 8 of the Office Action mailed on 4/22/2008.

***Response to Arguments***

9. Applicants' arguments filed October 21, 2008 have been fully considered but they are not persuasive.

Claims 58-68 and 35 U.S.C. § 103(a)

Reiss et al in view of Nicolau

The rejection of claims 58-68 under 35 U.S.C. § 103(a) as being unpatentable over Reiss in view of Nicolau is respectfully traversed. As recognized by the Office, Reiss discloses a one-step method for the production of core/shell nanocrystals and thus fails to teach a method wherein a cation precursor solution and an anion precursor solution are added in an alternating manner to a solution of core nanocrystals. Nicolau likewise does not teach or suggest the alternating application of cation and anion precursor solutions to a solution of core nanocrystals. Nicolau discloses a method of immersing a unitary substrate in various individual salt solutions with rinsing between immersions. The rinsing step required by Nicolau is administered to clear the substrate of excess solution thereby facilitating the formation of at least two superimposed ionic layers. The independent salt solutions and the requirement of rinsing between immersions preclude Nicolau from teaching or suggesting a method, as recited in the independent claims 58 and 59, wherein a mixture comprising a solution of core nanocrystals, a cation precursor solution, and an anion precursor solution is formed. Additionally, it is improper to combine references where the references teach away from their combination. In re Grasselli, 713 F.2d 731, 218 USPQ 769 (Fed Cir. 1983) and MPEP § 2145.X.D.2. The one-step, simultaneous combination of cation and anion species described by Reiss teaches away from the alternating immersion steps of Nicolau. Moreover, Reiss further teaches away from Nicolau by providing a plurality of nanocrystalline substrates. A plurality of nanocrystalline substrates is fundamentally inconsistent with the large unitary substrates of Nicolau having surface areas of 10 to 1,000 cm<sup>2</sup>. Furthermore, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. In re Ratti, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

The Examiner respectfully disagrees with this argument. One of ordinary skill in the art would easily recognize that cation/anion shell will deposit on the surface of any shape whether the surface is of particles or of unitary substrate since chemistry of cation and anion would not change because of the shape of the substrate surface. In other words, deposition in solution with providing cationic and anionic constituents in an alternating manner would permit deposition of monocrystalline or polycrystalline, fault-free, compact layers of compounds of formula C<sub>m</sub>A<sub>n</sub> (wherein C represents a cation, A represents an anion) having *homogeneous* thickness and desired *stoichiometry* of the deposited compounds in contrast to the presently known processes of *simultaneous* addition of cationic and anionic constituents no matter in what kind of shape the substrate is present in the solution.

The secondary references Kondow and Nicolau teach that changing simultaneous addition of cationic and anionic constituents as in Reiss to alternating addition would provide deposition of monocrystalline or polycrystalline, fault-free, compact layers of compounds of

Art Unit: 1792

formula  $C_mA_n$  (C represents a cation, A represents an anion) having *homogeneous* thickness and desired *stoichiometry* of the deposited compounds in contrast to deposition in solution with simultaneous addition of cationic and anionic constituents advantages. Thus, the secondary references of Kondow and Nicolau provide a *strong motivation* to change operation in Reiss to a better operation, i.e. changing operation in Reiss would be *prima facie* obvious.

Reiss et al in view of Nicolau, further in view of state of art admitted by Li et al

Li is an improper prior art reference. The Examiner provides a publication date of September 23, 2003 for Li. The present application claims priority to a provisional application filed January 22, 2003 containing sufficient disclosure of the presently claimed methods. As a result, Applicants respectfully assert that reliance upon Li as a blueprint to find obviousness is improper and request removal of the Li reference.

The Examiner respectfully disagrees with this argument. In contrast to Applicants argument, the OA relied not on Li et al itself but on the state of art<sup>38,39</sup>, admitted by Li et al on page 12568, column 2, second paragraph. References 38 and 39 have dates: 1989 and 2002 respectively.

Reiss in view of Kondow and Nicolau

Kondow fails to cure the deficiencies of Reiss and Nicolau. Kondow is limited to vacuum conditions, and does not address solution phase synthetic techniques. While the Examiner asserts that Nicolau compares his process to vapor phase deposition and deposition in solution, Nicolau only references vapor deposition and solution deposition as known processes for crystalline film growth and proceeds with describing the disadvantages of each. Nicolau does not equate vapor phase deposition techniques such as chemical vapor deposition and molecular beam epitaxy with solution phase techniques. Thus, it is improper for the Office to equate high vacuum synthetic techniques, such as those described by Kondow, with the solution phase synthetic techniques of the present invention.

The Examiner respectfully disagrees with this argument. First of all, in contrast to Applicants argument, Kondow is not limited to vacuum conditions, and does address solution phase synthetic techniques. Kondow et al teaches that atomic-layer-epitaxy (ALE) technique providing cationic and anionic species in an alternating manner permits epitaxial growth in the crystal structure converted from the bulk state (See column 3, lines 42-47), whereas the liquid phase epitaxial growth technique wherein a large amount of anion atoms and cation atoms are *simultaneously* supplied to the growing surface, the probability that the supplied anion atoms

and cation atoms are bonded with each other is much higher than the probability that the supplied cation atoms (or anion atoms) are bonded to the anion atoms (or cation atoms) on the growing surface, thus making it impossible to realize intended epitaxial growth (See column 3, lines 56-66). Second, the secondary references Kondow and Nicolau teach that changing simultaneous addition of cationic and anionic constituents as in Reiss to alternating addition would diminish the probability that the supplied anion atoms and cation atoms are bonded with each other but not on surface. Thus, the secondary references of Kondow and Nicolau provide a *strong motivation* to change operation in Reiss to a better operation, i.e. changing operation in Reiss would be prima facie obvious.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elena Tsoy Lightfoot whose telephone number is 571-272-1429. The examiner can normally be reached on Monday-Friday, 9:00AM - 5:30 PM.

Art Unit: 1792

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Elena Tsoy Lightfoot, Ph.D.  
Primary Examiner  
Art Unit 1792

December 20, 2008

/Elena Tsoy Lightfoot/